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Growth and Yield Responses of Curry Plant (*Murraya koenigii*) to Plant Row Spacing in an Utisol

O. A. Agba[1*]

[1]Department of Agronomy, Faculty of Agriculture and Forestry, Cross River University of Technology, Obubra, Cross River State, Nigeria.

Author's contribution

The sole author designed, analysed, interpreted and prepared the manuscript.

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ABSTRACT

Curry plant (*Murraya koenigii*) is one of the most important vegetable spices crops use for food, spice, medicinal and industrial purposes in Nigeria. However, curry plant production in commercial scale in Nigeria is highly constrained by several factors: it is not cultivated in regular farming system mainly due to lack of planting materials and improper plant spacing of this crop among others.

Therefore, field experiments were conducted to determine the effect of different levels of plant row spacing on growth and yield of Curry plant (*Murraya koenigii*) in Cross River University of Technology, Teaching and Research farm, Department of Agronomy, Obubra, Cross River state, Nigeria in 2017 and 2018 cropping seasons. The experimental design was a randomized complete block design. Treatments were nine plant row spacing (70 x 50 cm, 70 x 70 cm, 80 x 40 cm, 80x60 cm, 90 x 30 cm, 100 x 50 cm, 100 x 70 cm, 100 x100 cm and 100 x130 cm) inter and intra row respectively with four replications. Results showed that plant row spacing have significantly affect the growth and yield of Curry plant. Closer plant row spacing of 70 x 50 cm significantly promoted

**Corresponding author: E-mail: aakongwubel@yahoo.com, Oliveragba50@gmail.com;*

the tallest plant height and highest leaf area inde x values of curry plant. Fresh and dry leaf yield on per hectare basis were significantly higher in closer plant row spacing than wider row spacing. The highest fresh and dry leaves yield per hectare at 20 weeks after planting (WAP) of 0.9742t/ha and 0.9871t/ha were obtained in closer row spacing of 70 x 50 cm in 2017 and 2018 cropping seasons respectively .
The number of leaves and branches per plant and their fresh leaf yield and dry matter of plant fractions were higher in wider plant row spacing plots. The wide plant row spacing of 100 x 130 cm produced the highest fresh leaf yield per plant of 88.54 g in 2017 and 83.46 g in 2018 cropping seasons. Based on this result farmers are advised to cultivate Curry plant *(Murraya koenigii)* using the plant row spacing of 70 x 50 or 80 x 60 cm for optimum growth and yield per hectare of the crop under the utisoil condition.

Keywords: Curry plant; Murraya koenigii; spacing; growth and yield.

1. INTRODUCTION

Curry plant is one of the most important vegetable spices crops use for food, medicinal and industrial purposes in Nigeria. Curry plant botanical name is *Murraya koenigii,* belongs to the family *Rutaceace* [1], is one of the under–exploited crop species in Nigeria but has high economic importance. It is a small herbal plant that can grow up to the height of 50 to 100 cm or more tall depending on the soil fertility status, a girth diameter of about 15—50 mm depending on the soil fertility [2]. The leaves are pinnate with 1-2 leaflets, each leaflet is 2-4 cm long and 1-2 cm broad. The flowers are small, white and produce small black shiny berries fruits [1]. The crop is widely use as spice, condiments and food additives. The aromatic spicy leaves are used extensively for culinary purpose, especially for seasoning and flavoring of dishes and food stuffs [3].

Ethano botanical studies on Curry plant (*Murraya koenigii*) *shows* that it is a rich source of alkaloids, leaves contain nutrients such as amino-acids, minerals and phytochemicals [3,4]. The constituent especially the phytochemicals are responsible for the aromatic and medicinal properties of the plants [1].

The plant is widely used in traditional medicine in the management of stomach ache, cough and dysentery and in checking vomiting and reducing cholesterol level in the blood [2]. In most parts of Nigeria many people prefer to use natural spices such as leaves, shoots and inflorescence as food additives from plant origin (Curry plant, *Ocimum gratissimum* and others plants) to prepare their food than the powder canned spices that are artificially prepared food industries.

However, curry plant production in commercial scale in Nigeria is highly constrained by several factors. It is not fully introduce to regular farming system mainly due to lack of planting materials and inappropriate agronomic practice and improper plant spacing of this crop.

Despite the economic importance of Curry plant (*Murraya koenigii*) there is scanty literature information on the cultivation of the crop in regular farms on commercial scale. The demand for large commercial quantity of Curry plant (*Murraya koenigii*) and it products is a big problem in Nigeria due to absence of commercial farms that will guarantee large scale supply at regular interval.

In Cross River State, South-South, Nigeria, few peasant women cultivate Curry plant (*Murraya koenigii*) at the back of their kitchen or in small patches in their compound at subsistence level for their house use without due consideration to the plant row spacing, cutting management (harvesting interval) and fertilizer requirements and other cultivation techniques of the crop. The cultural techniques such as adequate plant row spacing or planting distance of the crop in Utisol is lacking. Therefore, the aim of this studies was to determine the effects of different levels of plant row spacing on the growth and yield of Curry plant (*Murraya koenigii*) in an Utisol, Cross River State, South-South Nigeria.

2. MATERIALS AND METHODS

2.1 Description of Experimental Site

The experiments were conducted in Cross River University of technology, Faculty of Agriculture and Forestry, Teaching and Research farm of Agronomy Department Obubra, Cross River State, South-South, Nigeria. The Geographical location of the area is at Longitude 08°15” East of the Greenwich meridian and Latitude 05°58”

North of Equator with annual rainfall of 2000—2500 mm and the average temperature of the area is ranging from 25°C – 32°C. Cross River Agricultural Development Project [5]. The experiment was carried out during the rainy season of 2017 and 2018 respectively. The rainy season in the study area occurs between March and October.

2.2 Land Preparation Start Here 9/9/19

The experimental field used for this study was under two years fallow when it was cleared, stumped, packed, ploughed and harrowed manually on 25th March, 2017 and 2018. The field was then marked out into four blocks that was sub-divided into nine (9) plots of 4 x 3 m (12 m^2) which was separated by 0.5 m path- way and 1.0 m between adjourning plots.

2.3 Experimental Design

The experiment was laid out in a randomized complete block design (RCBD). Nine Plant row spacing of 70 x 50 cm, 70 x 70 cm, 80 x 40 cm, 80 x60 cm, 90 x 30 cm, 100 x 50 cm, 100 x 70 cm, 100 x 100 cm and 100 x 130 cm inter and intra row respectively comprised the experimental treatments. The nine treatments were allocated at random to the nine plots in each of the four blocks that made up the experiment using a table of random numbers. Each plot was tag with the appropriate treatment (plant row spacing) for easy identification. The nine treatments were replicated four times in four blocks. These plant row spacing were used because of lack of the study area lack information on plant row spacing of curry plant. This present study is one that is to form a base or foundation for future research on cultivation or agronomic techniques require for optimum cultivation of curry plant in this region.

2.4 Planting

Planting of curry plant was done using seeds obtained from a local woman who cultivate the plant behind her kitchen for household use because there is no any other source for improved planting material for curry plant. The seeds were first broadcast in a small nursery close to the experimental field. The seedlings were raised for three weeks in the nursery before transplanted to the main plots in the experimental site. Transplanting of seedlings was done by uprooting the curry plant seedlings with the ball of the earth. The seedlings were planted in their appropriate plots that were properly tag and label with their respective plant row spacing on April 20th 2017 and 2018 according to the designated treatments stated in this study experimental design.

2.5 Cultural Practices

Weed control in the experimental plots was done manually using a hand weeding hoe at four periods at 14th May, July, September and November in each year (2017 and 2018) to keep the plots clean.

2.6 Data Collection

2.6.1 Plant height, number of leaves and leaves per plant

At the on set of the measurement of vegetative parameters, twelve (12) plants were selected at random from each plot. For easy identification they were label and tag for data collection and mean from the 12 chosen plants was used to record plant height, leaves and branches number per plant. The plant height was measured with a meter rule from soil level to the apex top of each of the 12 selected plants per plot and the calculated mean used as plant height.

Branches and leaves number per plant was determine by counting the branches and green leaves.

Leaf area was measured using the leaf area meter (Model-MK-2) from leaves of 12 plants collected at random from each plot.

Leaf area index was determined using the measured leaf area according to the relationship as stated by Shortal [6] indicated below

$$LAI = Y \times N \times A_1 \times (Ap)^{-1}$$

Where:

LAI = leaf area index,
Y = population of plants per plot,
N = Average number of leaves per plant.
A_1 = Average area per leaf,
Ap = Area of plot.

2.6.2 Dry matter of plant fractions

Dry matter of plant fractions was determined through destructive sampling of one plant per

plot. The sampled plants were oven dried in paper envelop at 80°C for 72 hours to measure the leaves and stem dried weight per plant using a electronic weighing balance at 8,12 and 20 weeks after planting (WAP) in 2017 and 2018 cropping seasons respectively.

2.6.3 Crop growth rate analysis

Destructive sampling of one plant per plot was done to measure the curry plant growth rate at 4-8WAP, 8-12WAP, 12-18WAP, in the 2017 and 2018 respectively. The sampled plants were taken to the laboratory, separated to leaves, stem, root and oven dried to constant weight. The growth analysis techniques described by Shortal and Liebbardt [6] was used to determine the crop growth rate as stated below:

Crop Growth Rate (CGR) = W2 - W1 / SA (t2 - t1) g/m2/day

Where

W1 and W2 = dry weight of nodule at beginning and end of the interval of growth period, t1 and t2 = sampling time 1 and 2, SA = the area occupied by the plant at sampling.

2.6.4 Harvesting

Curry plant was harvested through cutting of the fresh immature leaves and shoots at interval of 8 weeks after planting(WAP), 16WAP and 20WAP in both years (2017 and 2018). During each harvest, the weight of the leaves and seeds yield of each harvested plant and plot were recorded on per plant and hectare basis using electronic weighing balance. *Murraya koenigii* is a perennial crop depending on availability of rain. In areas where moisture is a limiting factor the crop will be annual. Harvesting of fresh leaves began at 8 weeks after planting because most people in Cross River State, Nigeria like the immature soft leaves at 8 weeks for food and medicinal purposes more than at older age when flowering and fruiting begins.

This experiment terminated at ten months in the two cropping seasons (2017 and 2018) due to dry season that set in at the sits of the experimental. Thus harvesting of the fresh leaves need to begin early to reap more benefit from the plant before complete dry weather set in at location of the experimental site when the will be no water needed for vegetative growth.

2.7 Statistical Analysis

Analysis of variance (ANOVA) procedure for randomized complete block design experiments as out lined by Gomez and Gomez [7] was used to analyse the data collected .Separation of treatments means that were significant as was done using Fishers least significance difference (F-LSD) at 5% probability level as out lined by Obi [8].

3. RESULTS AND DISCUSSION

The weather condition of the experimental sites obtained from the meteorological station is summarized in Table 1. Rain fall was high to support curry plant growth throughout the two cropping seasons of 2017 and 2018. The rainfall pattern shows a bimodal nature with the highest peak of maximum rainfall in the months of July (528.7 mm in 2017 and 716.6 mm in 2018) and September (481.8 mm in 2017 and 488.5 mm in 2018). There was a little break in the months of August, of the two years 2017 and 2018 respectively. However, all the months of 2018 except October recorded higher rainfall than those of 2017. Relative humidity and temperature closely followed the similar pattern as that of the rainfall in the two cropping seasons presented in Table 1.

Wider Plant row spacing gave higher number of leaves per plant than closer plant row spacing Table 2. The number of Curry leaves per plant significantly increases with increase in plant row spacing. The highest numbers of leaves per plant at 20WAP (50.15 in 2017) and (52.12 in 2018) were recorded in the wider row spacing of 100 x 130 cm inter and intra row spacing respectively. The effects of plant row spacing on number of branches per plant closely followed the same trend as their effects on the number of leaves per plant which increase as the plant row spacing increases shown in Table 2. The significant increased in number of leaves and branches per plant of curry plant in wider row plots obtained in this study corroborate the findings of Islam et al. [9] who reported increased in number of okra leaves sown in wider intra row spacing of 60 cm x 60 cm as compared with narrow plant row spacing of 60 cm x 30 cm.

Result shown that closer row spacing resulted in taller curry plant height as compared with wider row spacing Table 2. Plots planted with closer intra row spacing of 70 cm x 50 had the tallest curry plant height at 20 weeks after planting

(WAP) of 88.92 cm in 2017 and 87.24 cm in 2018 cropping seasons. Similarly leaf area index was higher in narrow plant row spacing than the wider row space plants Table 2. The taller curry plants with significantly higher value of leaf area index observed in closer intra row spacing in this study could be attributed to the high curry plants population associated with narrow spacing this could probably increase faster development of leaf area index resulting to earlier leaf canopy cover that promoted taller plants in the higher plant population plots. This result agreed with the findings of Falodun and Ogedegbe [10] who recorded significantly higher leaf area index value and taller plant height in closer row spacing.

The results of the present study for these significant increase in vegetative growth characters maximum numbers of leaves and branches) per plant recorded in wider row spacing is in agreement with the findings of Falodun and Ogedegbe [10] who reported that the wider row spacing with lowest plant density treatment obtained from the widest spacing produced the highest number of branches and leaves per plant. This might be due to the fact that plants of wider spacing could receive more light nutrients and other resources than the plants of close spacing. Thereby resulting higher characters (more leaves and branches) than the others.

The effects of plant row spacing on the dry matter of plant fractions is summarize in Table 3. The leaf dry weight per plant was low in narrow row spacing than the wider row spacing. Effects of spacing on the stem dry weight per plant closely followed the same trend as that of leaf dry weight that was significantly higher in wider row spacing than in the narrow row spacing.

Similarly, curry growth rate recorde d as dry matter accumulation in plant parts (leaf and stem) g/m^2/day increases with increased in plant row spacing, the maximum leaf growth rate (1.5677 g/m^2/day in 2017 and 1.6234 g/m^2/day in 2018) and stem growth rate (2.41256 g/m^2/day in 2017 and 2.2568 g/m^2/day in 2018) were recorded in plots with plant row spacing of 100 x 130 cm inter and intra row spacing respectively in the two cropping seasons respectively Table 3. The lower values in the dry matter weight of the leaf and stem recorded in this study might probably be due to high competition for nutrient, moisture, and sunlight occasion by over populated curry plants in the closer row spaced plots. This result of the present study corroborates the study of Maurya et al. [11] who reported increased in dry matter of the leaves in wider row spacing crops as compared with that of the narrow row spacing in okra plants.

Fresh curry leaf yield per plant was significantly influenced by spacing levels Table 4. The maximum fresh leaf yield per plant at 20 weeks after planting (WAP) (88.54 g in 2017 and 83.46 g in 2018) was recorded from the widest spacing (100×1300 cm) and differed significantly higher from that of the other plant row spacing. The lowest yield (25.26 g in 2017 and 23.66 g in 2018) per plant was obtained from the closest spacing (70 x 50 cm).

Dry curry leaf yield per plant follow the same trend as the effects of plant row spacing on the fresh curry plant leaf yield per plant. The wider plant row spacing facilitated the plants to develop properly with less inter and intra plant competition for utilizing the available resources such as (light, nutrients air and even space). The curry plants make maximum used of the available resources for photosynthesis thus resulting in higher yield per plant. On the other hand, in narrow intra row spacing the reduced curry leaf yield per plant might be attributed to the high plant density and increased intra specific competition with the consequent low leaf yield per plant. The present experiment is in agreement with the findings of Falodun and Ogedegbe [10] who also obtained the highest yield with the wide intra row spacing treatment of 100 × 60 cm.

Plant row spacing had significant effect on curry leaf yield per plot and per hectare Table 4.

The closest spacing (70 x 50 cm) produced the maximum fresh curry leaf yield at 20WAP of (0.9742t/ha in 2017 and 0.9871 t/ha in 2018) and the widest plant row (100 x 130 cm) spacing showed the minimum (0.3443t/ha in 2017 and 0.3857t/ha in 2018. The effects of plant row spacing on the curry leaf dry weight per hectare closely followed the same trend as that on the curry plant fresh leaf yield per hectare Table 4. The decline in reproductive parameter especially fresh leaf and seed yield per hectare, observed when plant row spacing increased to (100 cm x 130 cm) could be an indication that the planting spacing of (100 x 130 cm) may not be economically viable in the production of curry plant fresh leaves and seeds. On the other hand, the better yield obtained under the narrower

Table 1. Meteorological weather data of the experimental sites of 2017 and 2018 cropping seasons

Weather parameters	Months																							
	March		April		May		June		July		August		September		October		November		December		Total		Mean	
	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018	2017	2018
Rainfall (mm)	114.2	123.7	196.4	216.5	275.8	301.4	448.5	413.7	528.7	716.6	308.7	3412.3	481.8	488.5	278.5	301.4	102.4	92.3	38.8	25.3	2773.8	6148.7	277.38	614.87
Relative Humidity (%)	74.6	76.8	79.9	80.5	82.1	83.5	84.6	86.3	87.3	88.6	76.7	78.3	81.3	80.2	78.8	76.5	77.4	78.3	70.3	71.4	793	800.4	79.3	80.04
	Temperature (°C)																							
Maximum	33.8	33.6	33.7	33.4	32.7	32.5	30.7	30.5	30.3	30.2	32.4	32.2	31.3	31.1	30.5	30.3	29.4	29.5	28.4	28.2	313.2	301.5	31.33	31.15
Minimum	26.4	26.5	24.8	24.6	24.2	24.3	23.3	23.1	22.4	22.3	24.6	24.5	22.5	22.3	22.3	22.2	20.2	20.4	20.2	20.3	252.2	230.5	25.22	23..05

Sources: Department of Agronomy, Faculty of Agriculture, Cross River University of Technology, Obubra, Cross River State, Nigeria

Table 2. Effects of plant row spacing on the plant height (cm), number of leaves, branches per plant and leaf area index on curry plant curry *(Murraya koenigii)* in 2017 and 2018 cropping season

Treatments	Number of leaves per plant						Leaf Area Index (LAI)						Number of branches per plant						Plant height (cm)					
Plant row spacing (cm)	2017			2018			2017			2018			2017			2018			2017			2018		
	8 WAP	12 WAP	20 WAP	8 WAP	12 WAP	20 WAP	8 WAP	12 WAP	20 WAP	8 WAP	12 WAP	20 WAP	8 WAP	12 WAP	20 WAP	8 WAP	12 WAP	20 WAP	8 WAP	12 WAP	20 WAP	8 WAP	12 WAP	20 WAP
70 x 50 cm	5.11	10.1	18.33	6.10	9.32	17.23	0.00432	0.0925	1.5442	0.00425	0.0933	1.6112	1.01	2.11	4.1	1.0	2.10	4.0	25.72	67.87	88.92	26.35	68.13	87.24
70 x 70 cm	7.21	13.13	21.14	8.13	12.24	22.31	0.00353	0.0732	1.2153	0.00351	0.0845	1.3021	1.00	2 .3	4.13	1.0	2.2	4.21	22.15	63.75	80.65	21.08	63.35	83.47
80 x 40 cm	10.13	14.21	25.23	10.42	16.13	26.11	0.00282	0.0627	0.860132	0.00311	0.0669	0.9143	1.02	3.1	5.21	1.0	3.o	4.31	19.21	60.84	77.54	20.35	62.35	79.32
80 x 80 cm	13.11	15.11	28.11	12.32	17.10	30.24	0.00247	0.0565	0.7969	0.00239	0.057	0.7827	1.0	3.2	5.23	1.01	3.2	5.13	17.12	57.41	72.64	18.43	59.26	73.52
90 x 30 cm	15.11	17.21	32.23	16.11	20.23	34.12	0.00221	0.04254	0.5459	0.00231	0.04342	0.6143	1.01	4 .1	5.32	1.01	4.11	5.23	15.32	54.65	68.75	16.25	56.13	69.48
100 x 50 cm	17.22	21.32	36.31	18.22	23.14	37.31	0.0017	0.0324	0.445	0.0018	0.0315	0.5042	1.01	4.2	6.0	1.01	4.2	6.02	14.22	49.57	63.51	14.37	50.18	65.35
100 x 70 cm	19.11	35.22	40.14	19.17	27.12	40.12	0.00153	0.0275	0.41062	0.00148	0.0273	0.4632	1.0	U3	6.1	1.1	4.4	6.11	12.13	45.81	58.66	12.18	46.25	60.27
100 x 100 cm	21.13	39.14	43.21	21.23	42.14	45.21	0.00123	0.02415	0.34045	0.00103	0.0264	0.3714	1.0	5.1	8.13	1.01	5.0	7.03	11.21	39.35	55.74	10.21	40.35	54.57
100 x 130 cm	24.32	41.21	50.15	24.13	45.31	52.12	0.00112	0.0145	0.2034	0.00115	0.0154	0.2156	1.01	5.2	9.22	1.01	5.3	8.21	10.61	35.81	50.83	9.55	37.21	51.48
LSD(0.05)	0.81	1.12	1.2	2.01	2.4	1.7	00.001	0.002	0.03	0.001	0.02	0.03	NS	0.001	0.3	NS	0.02	0.4	0.01	1.101	2.0	0.5	1.3	2.1

Table 3. Effects of plant row spacing on dry matter weight of leaves, stem per plant (g) and their growth rate (g/m^2/day) on curry plant curry *(Murraya koenigii)*

Treatments	Leaf dry wt.(g) per plant						Stem dry wt.(g) per plant						Leaf growth rate (g/m^2/day)						Stem growth rate (g/m^2/day)					
Plant row spacing (cm)	2017			2018			2017			2018			2017			2018			2017			2018		
	8 WAP	12 WAP	20 WAP	8 WAP	12 WAP	20 WAP	8 WAP	12 WAP	20 WAP	8 WAP	12 WAP	20 WAP	4-8 WAP	8-12 WAP	12-18 WAP	4-8 WAP	8-12 WAP	12-18 WAP	12-18 WAP	4-8 WAP	12-18 WAP	4-8 WAP	8-12 WAP	12-18 WAP
70 x 50 cm	0.0213	1.1234	3.1723	0.0234	1.3255	3.224	0.0423	2.1683	4.2163	0.04357	2.23214	4.1674	0.00012	0.023	0.3121	0.00014	0.0221	0.3312	0.0051	0.0732	0.3214	0.0040	0.0752	0.3451
70 x 70 cm	0.0321	1.6583	3.2438	0.0352	1.574	3.1351	0.0478	2.6369	5.1134	0.05123	2.4863	5.2351	0.00024	0.0335	0.4535	0.00016	0.0324	0.4371	0.0062	0.07714	0.5822	0.00613	0.07845	0.6126
80 x 40 cm	0.0389	2.1134	4.1326	0.03312	2.246	4.315	0.0613	3.1353	6.2416	0.06257	3.23415	6.14122	0.000531	0.0412	0.4823	0.0007	0.0512	0.5894	0.0065	0.08485	0.7243	0.00786	0.08612	0.7534
80 x 80 cm	0.0463	2.7584	5.2452	0.0447	2.6321	5.1083	0.0723	4.3254	7.432	0.07354	4.1432	8.1211	0.00061	0.0533	0.5136	0.0008	0.05781	0.61132	0.0073	0.08946	0.9012	0.00815	0.0932	1.03452
90x 30 cm	0,0478	3.2313	6.1527	0.0489	3.354	6.321	0.7936	5.1123	9.2225	0.0816	5.4322	9.3478	0.00068	0.0632	0.7013	0.0008	0.0623	0.7215	0.0084	0.09111	1.1232	0.08958	1.0427	1.5368
100 x 50 cm	0.0512	3.8352	7.2534	0.0513	3.6889	7.4432	0.08123	5.7432	12.358	0.09203	6.1275	14.245	0.00097	0.0816	0.9231	0.00096	0.0912	1.0124	0.01351	0.1246	1.5643	0.1214	1.0846	2.0023
100 x70 cm	0.0587	4.224	10.257	0.0591	4.2784	9.7989	0.08421	6.0362	17.2635	0.1246	7.8381	16.2347	0.0014	0.0865	0.9736	0.0022	1.011	1.1795	0.0425	0.2354	1.8739	0.03785	0.9523	2.3453
100 x 100 cm	0.0626	4.7565	12.4736	0.0641	4.6921	11.2463	0.1326	8.4251	23.3468	0.2135	9.4315	20.2762	0.0023	0.09042	1.234	0.0031	0.0213	1.2562	0.07338	0.52714	2.1111	0.06534	1.2047	2.7603
100 x130 cm	0.0789	5.1023	15.2813	0.077	5.2364	14.394	0.2145	12.3461	36.27	0.3416	11.2793	30.8215	0.0042	0.1353	1.5677	0.0043	0.0051	1.6234	0.0942	0.8756	2.41236	0.0926	1.7345	2.2563
LSD(0.05)	0.001	0.O1	0.51	0.01	0.31	0.56	0.43	1.01	1.13	0.012	2.03	2.12	0.01	0.02	0.03	0.001	0.02	0.02	0.04	0.051	0.03	0.02	00.003	0.005

Table 4. Effects of plant row spacing on fresh leave, dry leaves of curry plant (*Murraya koenigii)* in 2017 and 2018 cropping seasons

Treatment	Leaf fresh wt. per plant(g)						Leaf dry wt. per plant(g)						Leaf fresh wt. per hectare (t/ha/)						Leaf dry wt. per hectare (t/ha/)						Seed wt. per plant(g)	Seed wt. per plant(g)	Seed wt. Per Ha(t/ha)	Seed wt. per Ha (kg/ha)
Plant row spacing (cm)	2017			2018			2017			2018			2017			2018			2017			2018			2017	2018	2017	2018
	8 WAP	12 WAP	20 WAP	8 WAP	12 WAP	20 WAP	8 WAP	12 WAP	20 WAP	8 WAP	12 WAP	20 WAP	8 WAP	12 WAP	20 WAP	8 WAP	12 WAP	20 WAP	8 WAP	12 WAP	20 WAP	8 WAP	12 WAP	20 WAP				
70 x 50 cm	6.12	14.34	25.26	5.28	13.74	23.66	1.14	4.25	6.31	1.12	4.18	6.22	0.05547	0.06323	0.9742	0.0499	0.0735	0.9871	0.00078	0.00896	0.0684	0.000799	0.00869	0.0695	1.23	1.0674	0.04365	0.05212
70 x 70 cm	8.57	17.36	29.47	8.14	16.76	28.96	3.37	5.32	9.54	3.25	5.16	9.18	0.0417	0.0567	0.0 667	0.0462	0.06012	0.8111	0.000643	0.00874	0.0556	0.000611	0.046	0.06012	3.35	2.67	0.04152	0.04131
80 x 40 cm	11.23	22.15	34.28	12.16	23.38	36.11	6.45	8.29	13.58	6.24	8.13	12.76	0.0356	0.05324	0.6415	0.03748	0.0521	0.7153	0.000527	0.00733	0.05012	0.000516	0.00711	0.05432	3.86	3.84	0.03911	0.03892
80 x 80 cm	15.35	27.68	39.46	15.10	27.26	40.61	6.89	10.11	16.16	7.24	11.11	16.34	0.03127	0.0475	0.5861	0.0342	0.05012	0.6648	0.000443	0.006211	0.04101	0.000432	0.006034	0.04736	3.8764	3.6332C	0.03467	0.03384
90x 30 cm	18.82	32.35	43.18	19.65	30.98	44.78	7.56	14.27	19.35	7.82	13.41	19.42	0.02856	0.04451	0.5327	0.02759	0.04735	0.5487	0.000368	0.005613	0.04001	0.000334	0.00572	0.0411	4.86	4.54	0.02945	0.02836
100 x 50 cm	20.46	40.63	48.23	21.38	43.11	50.24	8.32	18.25	25.64	8.43	17.63	22.35	0.01974	0.0385	0.4777	0.02343	0.0444	0.5262	0.000373	0.00552	0.03795	0.0003442	0.005111	0.03564	4.37	4.25	0.02668	0.02577
100 x70 cm	25.31	50.14	63.26	24.78	49.78	60.57	13.48	23.13	29.46	12.46	21.46	31.52	0.01645	0.0347	0.3632	0.0188	0.0377	0.4859	0.000284	0.00462	0.03416	0.0002355	0.00445	0.031041	6.43	6.07	0.0178	0.175
100 x 100 cm	31.87	62.56	81.27	30.21	53.68	72.34	6.32	28.35	32.37	7.23	27.21	37.33	0.01524	0.0276	0.3052	0.0164	0.02812	0.4214	0.000243	0.00421	0.02725	0.000208	0.004011	0.02589	8.32	8.15	0.0146	0.0147
100 x130 cm	37.91	68.73	88.54	35.36	66.57	83.46	10.29	34.17	41.68	9.29	32.45	40.62	0.0101	0.02081	0.3443	0.0123	0.0215	0.3857	0.000186	0.003785	0.01752	0.0001798	0.003624	0.01853	9.15	8.78	0.0135	0.0133
LSD(0.05)	1.01	1.02	3.00	1.02	1.11	2.11	1.2	2	2.51	0.5	1.82	2.2	0.001	0.002	0.01	0.0001	0.001	0.01	0.0003	0.0001	0.0002	0.0001	.00003	0.0003	0.52	0.50	0.0001	0.0001

planting spacing could possibly imply that these spacing are adequate for curry plant fresh leaves and seeds production and that the plants had adequate ground cover and had higher plant biomass which aid in the reduction of soil moisture and nutrient loss.

This result agreed with the findings of Falodun and Ogedegbe [10] who reported higher seed yield per hectare of okra at the narrow plant row spacing as compared to wider plant row spacing.

4. CONCLUSION AND RECOMMENDATION

Curry plant is one of the most important vegetable spices crops use for food, medicinal and industrial purposes in Nigeria. However, curry plant production in commercial scale in Nigeria is highly constrained by several factors. Therefore based on the result of this study, farmers are advised to cultivate Curry plant *(Murraya koenigii)* using the plant row spacing of 70 x 50 or 80 x 60 cm for optimum growth and yield of the crop under the utisoil condition of the South-South, Nigeria agroecological zone.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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